Functional Regions of the Cerebral Cortex

- Cerebral cortex
  - Thin layer of gray matter that constitutes the outermost portion of cerebrum
  - Contains 75% of all neurons in the nervous system

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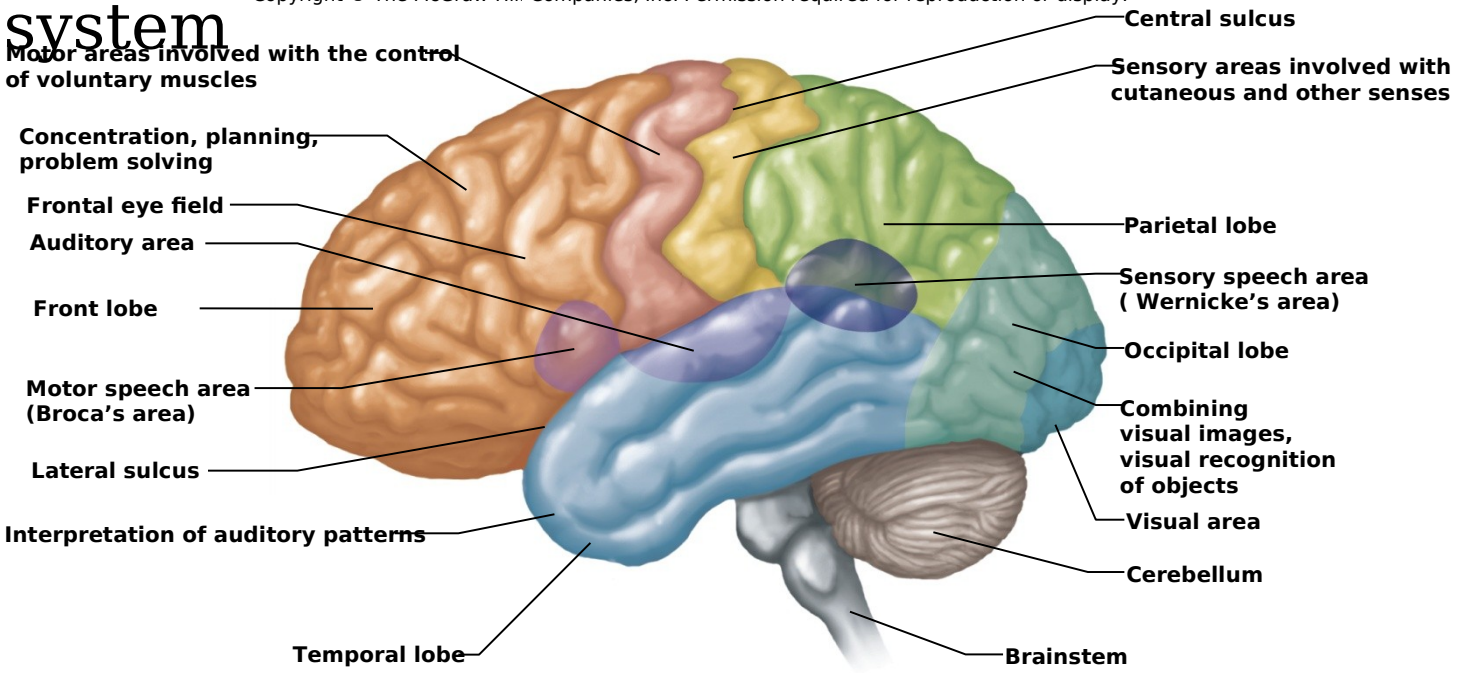

Functions of the Cerebral Lobes

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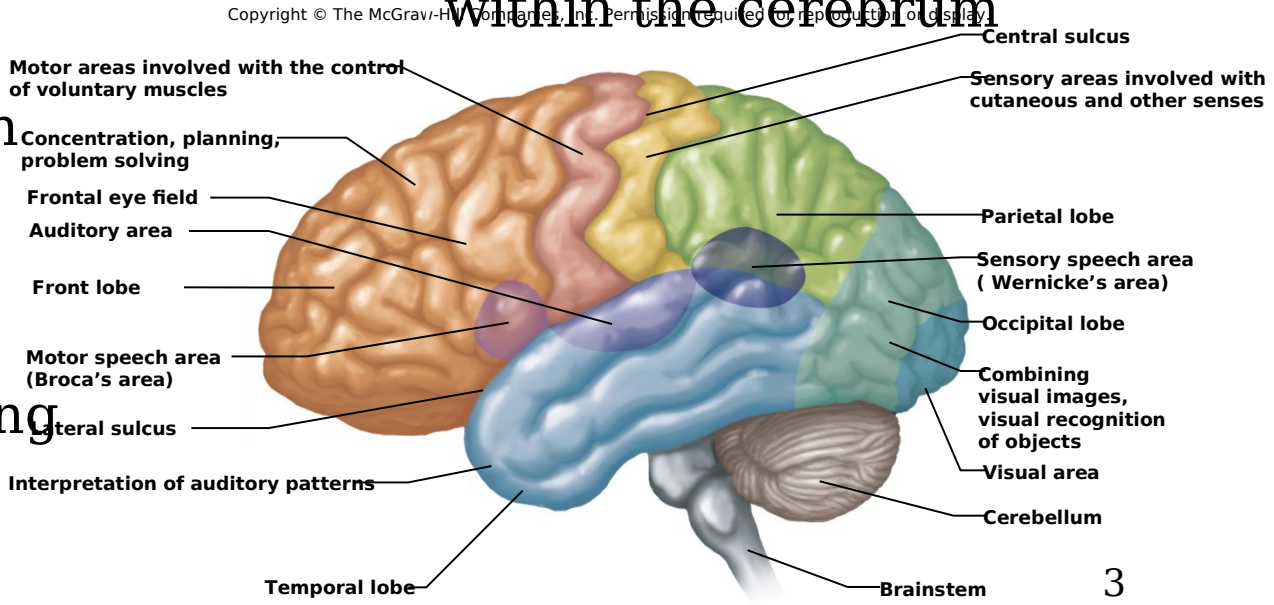
TABLE 11.5 | Functions of the Cerebral Lobes

Lobe	Functions
Frontal lobes	Association areas carry on higher intellectual processes for concentrating, planning, complex problem solving, and judging the consequences of behavior.
	Motor areas control movements of voluntary skeletal muscles.
Parietal lobes	Sensory areas provide sensations of temperature, touch, pressure, and pain involving the skin.
	Association areas function in understanding speech and in using words to express thoughts and feelings.
Temporal lobes	Sensory areas are responsible for hearing.
	Association areas interpret sensory experiences and remember visual scenes, music, and other complex sensory patterns.
Occipital lobes	Sensory areas are responsible for vision.
	Association areas combine visual images with other sensory experiences.

Sensory Areas (post-central sulcus)

- Cutaneous sensory area
  - Parietal lobe
  - Interprets sensations on skin
- Visual area
  - Occipital lobe
  - Interprets vision
- Auditory area
  - Temporal lobe
  - Interprets hearing
- Sensory area for taste
  - Near base of the central sulcus
- Sensory area for smell
  - Arises from centers deep within the cerebrum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Central sulcus
Motor areas involved with the control of voluntary muscles
Sensory areas involved with cutaneous and other senses
Concentration, planning, problem solving
Frontal eye field
Parietal lobe
Auditory area
Sensory speech area (Wernicke's area)
Front lobe
Occipital lobe
Motor speech area (Broca's area)
Combining visual images, visual recognition of objects
Lateral sulcus
Visual area
Interpretation of auditory patterns
Cerebellum
Temporal lobe
Brainstem

Sensory Areas

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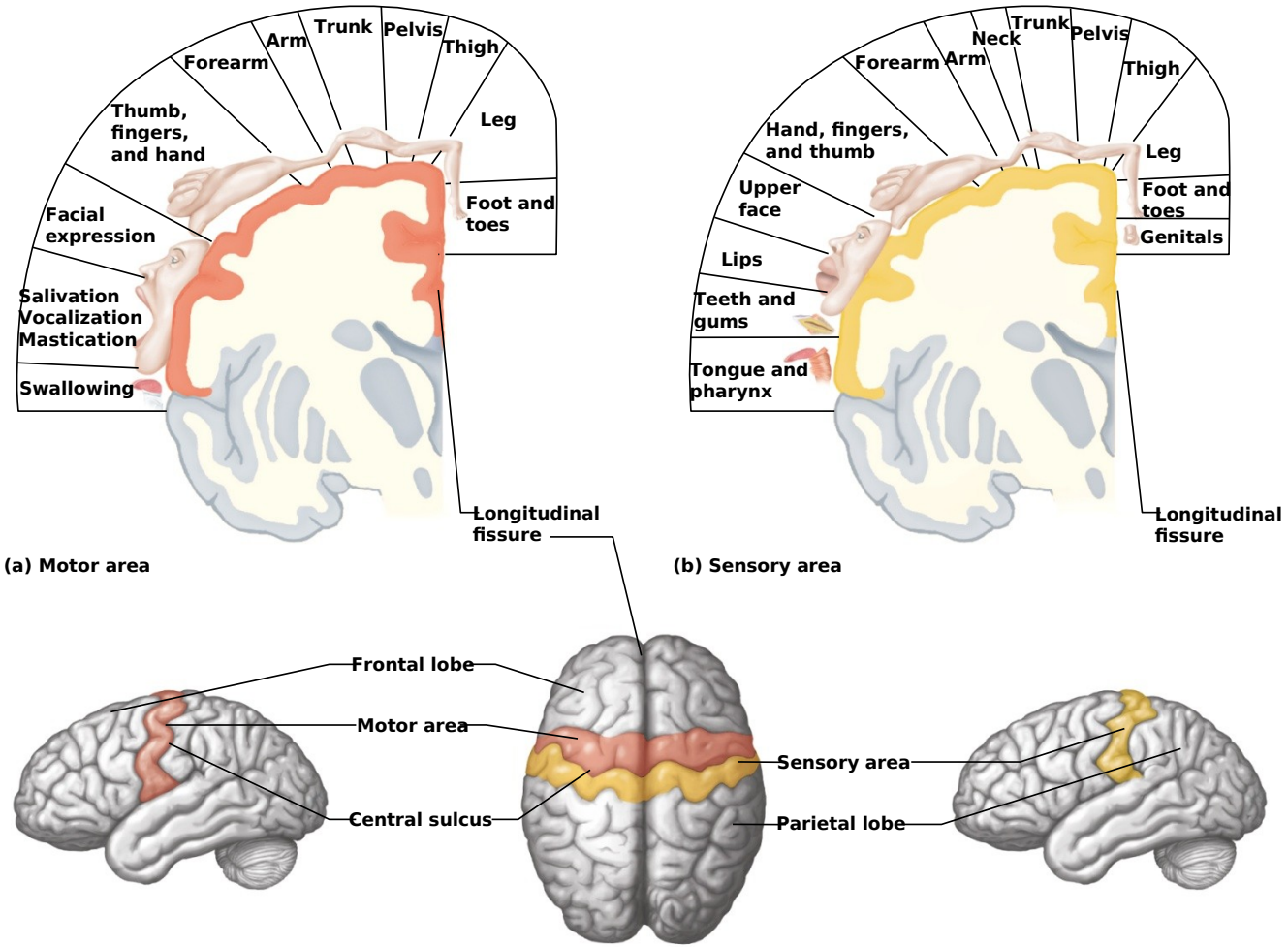
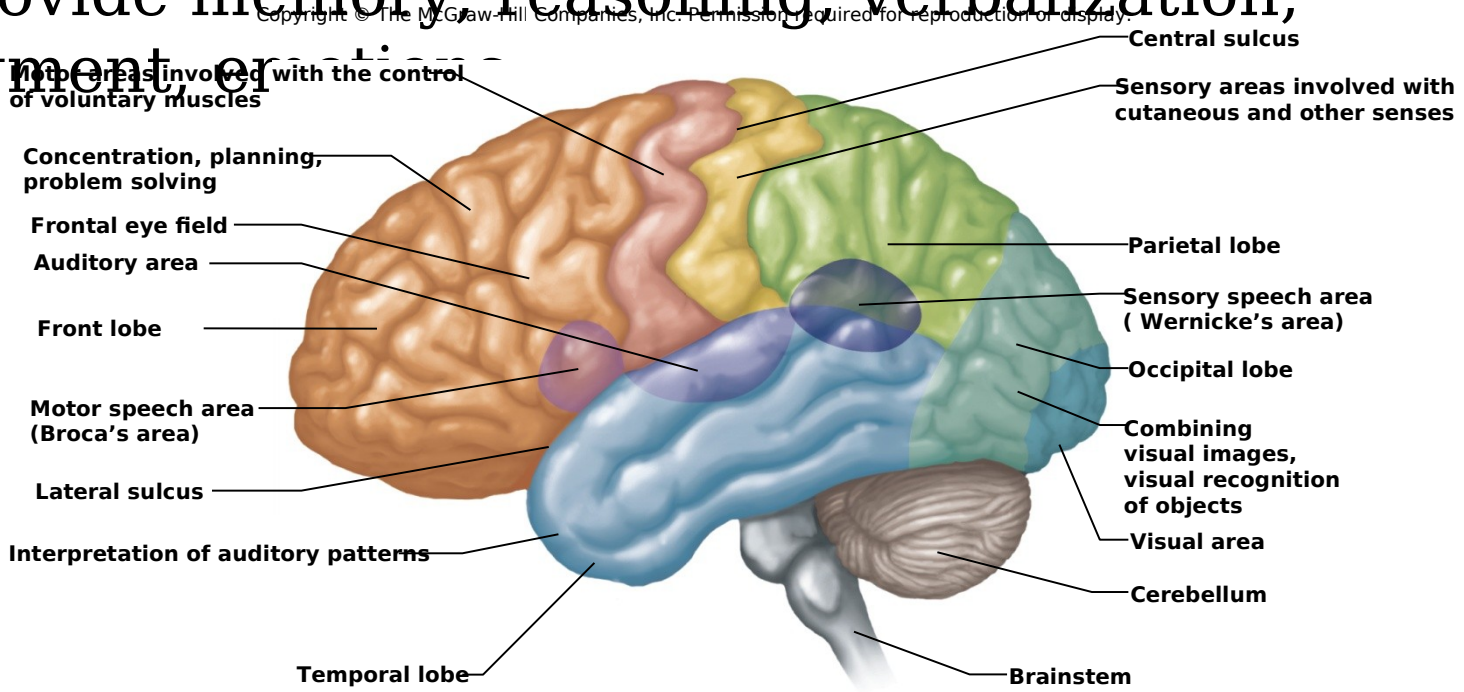


Association Areas

- Regions that are not primary motor or primary sensory areas
- Widespread throughout the cerebral cortex
- Analyze and interpret sensory experiences
- Provide memory, reasoning, verbalization, judgment, creativity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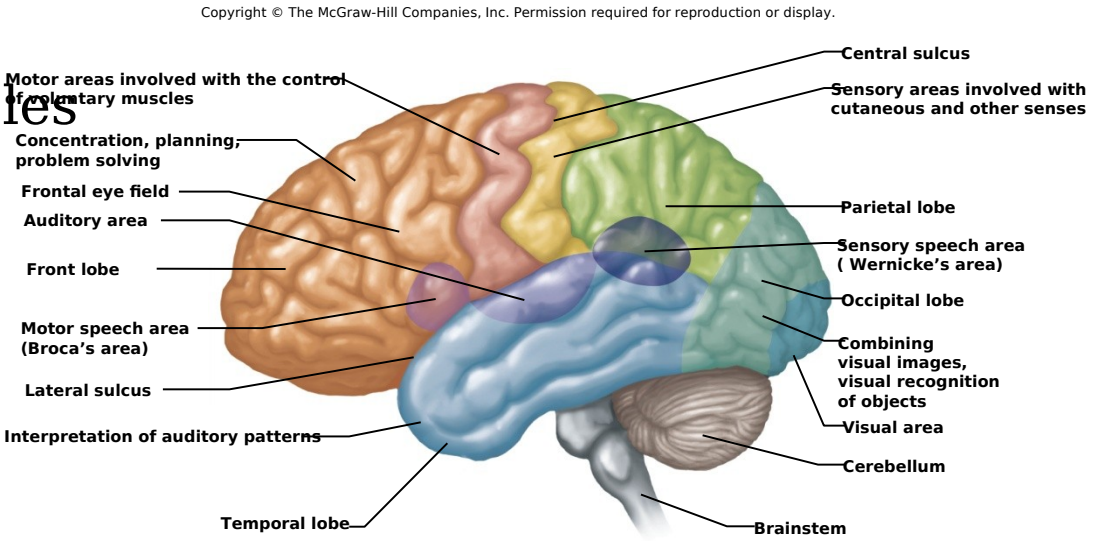
Brainstem

Association Areas

- Frontal lobe association areas
  - Concentrating
  - Planning
  - Complex problem solving
- Parietal lobe association areas
  - Understanding speech
  - Choosing words to express thought
- Temporal lobe association areas
  - Interpret complex sensory experiences
  - Store memories of visual scenes, music, and complex patterns
- Occipital lobe association areas
  - Analyze and combine visual images with other sensory experiences

Motor Areas (pre-central sulcus)

- Primary motor areas
  - Frontal lobes
  - Control voluntary muscles
- Broca's area
  - Anterior to primary motor cortex
  - Usually in left hemisphere
  - Controls muscles needed for speech
- Frontal eye field
  - Above Broca's area
  - Controls voluntary movements of eyes and eyelids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Motor Areas

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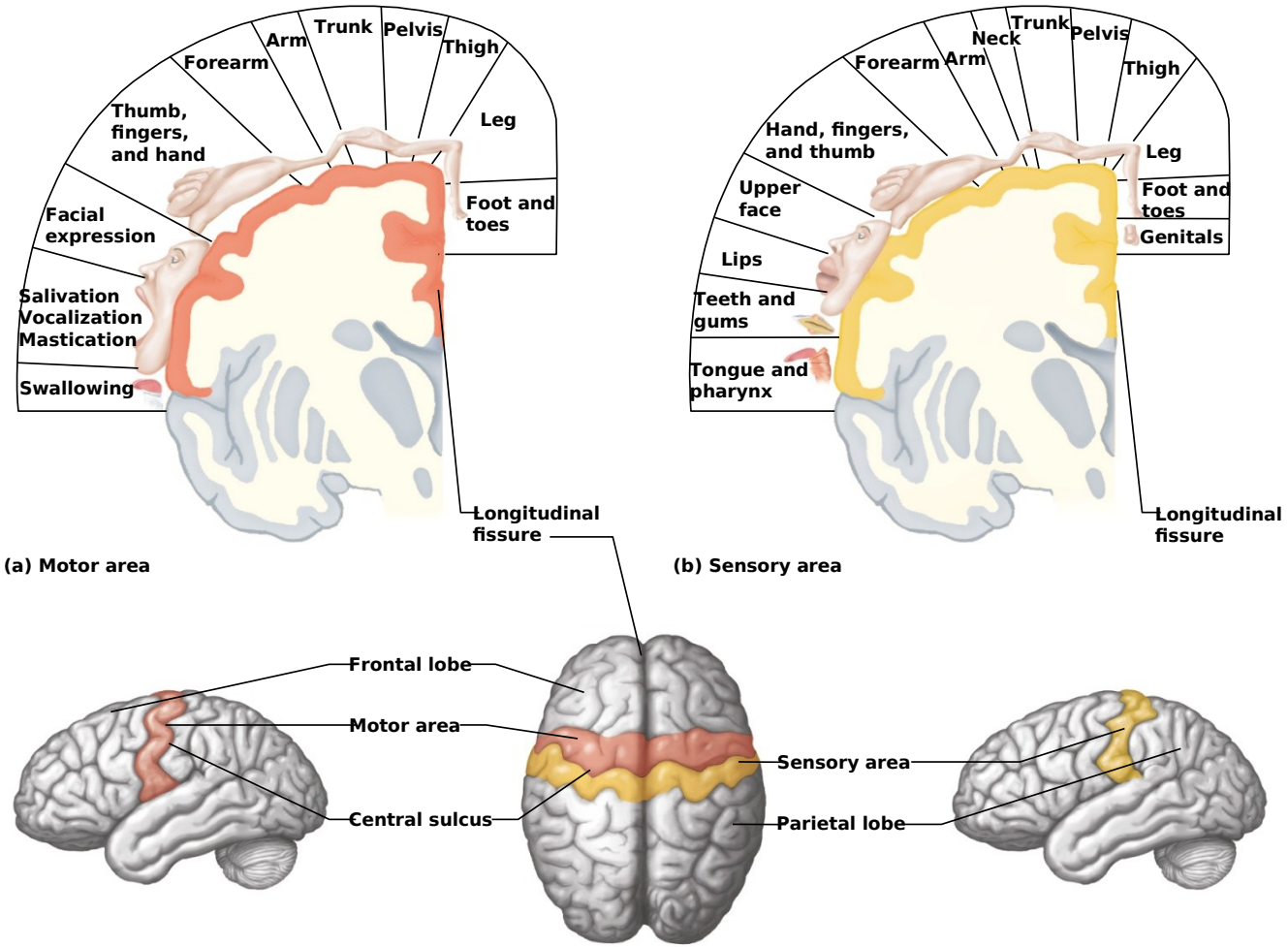


Hemisphere Dominance

The left hemisphere is dominant in most individuals

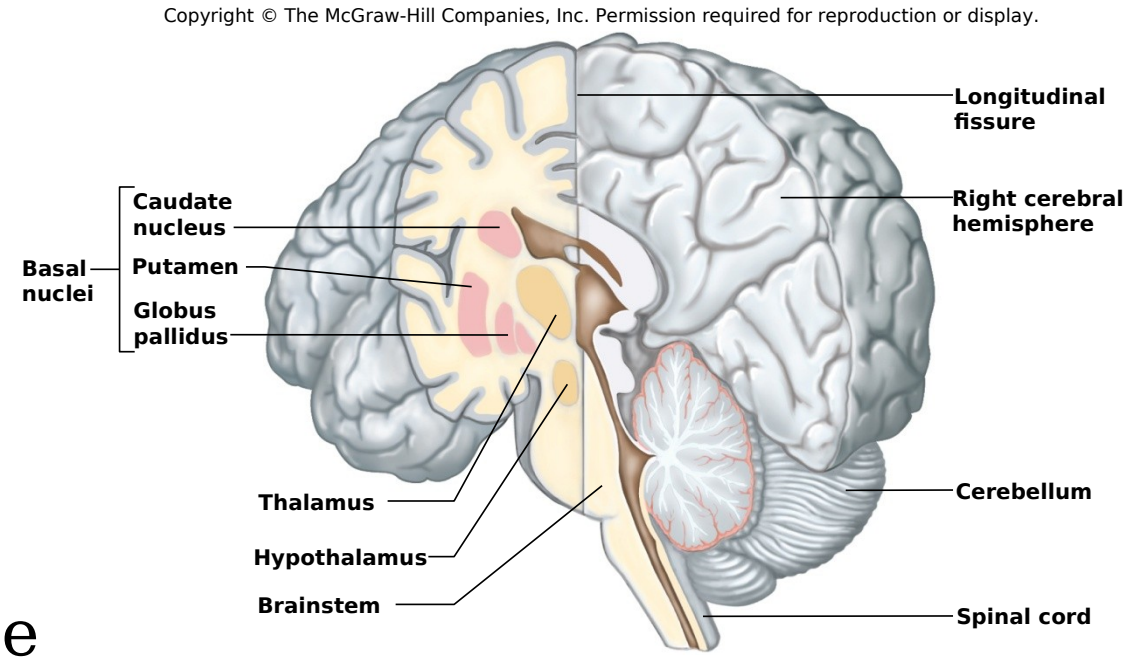
- Dominant hemisphere controls:
  - Speech
  - Writing
  - Reading
  - Verbal skills
  - Analytical skills
  - Computational skills
- Nondominant hemisphere controls:
  - Nonverbal tasks
  - Motor tasks
  - Understanding and interpreting musical and visual patterns
  - Provides emotional and intuitive thought processes

Memory

- Short term memory
  - Working memory
  - Closed neuronal circuit
  - Circuit is stimulated over and over
  - When impulse flow ceases, memory does also unless it enters long-term memory via memory consolidation
- Long term memory
  - Changes structure or function of neurons
  - Enhances synaptic transmission

Basal Nuclei

- Masses of gray matter
- Deep within cerebral hemispheres
- Caudate nucleus, putamen, and globus pallidus
- Produce dopamine
- Control certain muscular activities
    - Primarily by inhibiting motor



Diencephalon

Between cerebral hemispheres and above the brainstem
Surrounds the third ventricle

- Thalamus
- Hypothalamus
- Optic tracts
- Optic chiasm
- Posterior pituitary
- Pineal gland

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